IRON ORE

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U.S. iron ore production rose by almost 13% in 2004 compared with that of 2003; consumption rose by 5%. World iron ore production and consumption also rose in 2004. Brazil was the leading producer of iron ore in terms of iron content, while China led gross tonnage production and was by far the leading consumer (tables 1, 16). World iron ore trade increased for the third consecutive year, while prices continued to rise dramatically.

Iron ore supply is critical to the United States and all industrialized nations because it is the basic raw material from which iron and steel are made. Scrap can be considered a supplement to iron ore in the steelmaking process but is limited as a major feed material owing to inadequate supply of high-quality scrap. Direct reduced iron (DRI), although sometimes considered as an alternative, requires iron ore for its production.

The primary commercial minerals of iron ore are hematite (Fe_2O_3) and magnetite (Fe_3O_4), both iron oxides. Taconite, the principal iron ore mined in the United States, may contain hematite and magnetite and is found in hard, fine-grained, banded iron formations having a low (20% to 30%) iron content. About 99% of domestic iron ore is used in the iron and steel industry where it is transformed in a blast furnace to molten iron, usually referred to as pig iron. The molten iron goes directly to a basic oxygen furnace (BOF), eliminating the need for molds, and is converted to steel by removing most of the remaining carbon.

In 2004, the United States consumed 64.5 million metric tons (Mt) of iron ore, an increase of almost 3 Mt compared with that of 2003, and produced 42.3 Mt of pig iron. Pig iron production was slightly above 2001 levels after 2 years with the lowest production since 1982. Crude steel production at 100 Mt increased by 6% compared with that of 2003.

U.S. steel consumption increased to 117 Mt from 107 Mt in 2003. Domestically produced iron ore is supplemented with imports to produce pig iron that is used along with imported pig iron, DRI, and scrap to produce raw steel, which is used with imported raw steel to produce steel mill products, the material measured to characterize steel scrap. Integrated steel mills produce steel starting with iron ore; minimills produce steel from DRI and scrap. In 2004, the minimill sector of the steel industry produced more than 50% of the crude steel in the United States.

In 2004, net imports of iron ore substitute were 8.2 Mt, almost three times their tonnage for 2003, owing mainly to increases in net imports of 84% in pig iron, 56% in semifinished steel products, and 39% in DRI. These were somewhat offset by an increase in steel scrap net exports of 8%. Iron ore substitutes include DRI, iron and steel scrap, pig iron, and semifinished steel.

Use of imported pig iron or semifinished steel allows integrated steelmakers to increase steel shipments without increasing blast furnace production, thus avoiding major production increases, which in turn require restarting blast furnaces and employing additional skilled workers. When demand for steel falls, substitutes for iron ore help the highly cyclical steel industry avoid the shutdown of recently opened blast furnaces and the layoff of recent hires. So, a 6% increase in steel production coupled with a 9% rise in demand in 2004 resulted in iron ore consumption rising only slightly less than 5% from 2003 levels.

Legislation and Government Programs

Although no significant legislation affecting Minnesota production taxes passed during the 2004 legislative session, an escalator, based on the U.S. Department of Commerce's gross domestic product implicit price deflator, took effect and the rate increased to $2.103 per taxable metric ton. Minnesota's Department of Revenue Minerals Tax Office estimated that taconite production would increase by 14% in 2004 compared with that of 2003 to a total production of almost 40 Mt. This would be the highest annual pellet production for Minnesota since 2000 (KARE-11, 2004§[1]). Based on the U.S. Geological Survey (USGS) figures, Minnesota taconite pellet production increased by 16% more than the revised production for 2003.

Special legislation passed the Minnesota senate to encourage the development of the world's first 500,000-metric-ton-year (t/yr) DRI iron nugget plant, to be situated at the closed Cliffs Erie (LTV) site near Hoyt Lakes in St. Louis County (Hohnstadt, 2004). At the end of 2004, the State of Minnesota's Iron Range Resources (IRR) Board was negotiating economic incentives to assist the new DRI plant (Minnesota Department of Revenue, 2004§).

The IRR Board approved a $5 million loan to Minnesota Steel Industries LLC (MSI) as partial funding to develop a taconite mine, pelletizing plant, and a DRI plant in a steelmaking complex near Nashwauk on the Mesabi iron range. MSI's project would provide 700 jobs and require a $1.7 billion investment to produce 2.4 million metric tons per year (Mt/yr) of hot-rolled steel from more than 400 Mt of projected high-quality iron ore reserves (Bloomquist, 2004§; Ramsey, 2004§).

IRR announced a tax settlement between the State of Minnesota and creditors of National Steel Corp. Of the $12.4 million owed, slightly more than $10.0 million will be paid and distributed between area property tax relief, an economic production trust fund, and an environmental trust fund (Skillings Mining Review, 2004d).

[1]References that include a section mark (§) are found in the Internet References Cited section.

Structure of the Industry

In October, Ispat International N.V. (Rotterdam, Netherlands) agreed to acquire LNM Holdings N.V., while Ispat International and International Steel Group Inc. (ISG) (United States) agreed to merge. The newly combined company was renamed Mittal Steel Co. N.V. The new company became the world's leading producer and most globally diverse steel company (Skillings Mining Review, 2004b). Mittal Steel is the 100% owner of Ispat Inland Inc. (parent company of Ispat Inland Mining Company) with production capacity of about 2.7 Mt/yr from its Minorca Mine and plant and part owner of Hibbing Taconite Company, both in Minnesota.

Production

Domestic iron ore production at 54.7 Mt in 2004 increased by 13% from revised 2003 production. Taconite mines in Michigan and Minnesota accounted for virtually all domestic iron ore production. Six of these mines operated on the Mesabi Range in northeastern Minnesota and two on the Marquette Range in Michigan. Domestic iron ore supply (production minus exports) met 72% of domestic demand in 2004 more than the 69.5% average from 2000 through 2003.

The USGS develops U.S. iron ore production data through an annual "Iron Ore" survey, which provides 100% of production listed in tables 1 through 4. This information is supplemented by employment data, mine inspection reports, and information from consumers. The American Iron Ore Association no longer provides data on ore shipments from loading docks on the upper Great Lakes nor receipts at transfer docks and furnace yards nationwide. The dock and steel plant data are compiled by the American Iron and Steel Institute (AISI).

Cleveland-Cliffs Inc (Cliffs) announced an amendment to a major pellet sales and purchase agreement with ISG. The amended agreement raised the base price for pellets and moderated a steel-sharing provision within the agreement for pellet deliveries to ISG Cleveland and ISG Indiana Harbor through 2016 (Cleveland-Cliffs Inc, 2004a§).

ISG acquired the assets of Weirton Steel Corporation and assumed the pellet purchase contract with Cliffs with some modifications. The contract terms are for 15 years, with Cliffs supplying all pellet requirements for the ISG-Weirton facility after 2006. Cliffs sold 2.8 Mt of pellets to Weirton in 2003 (Cleveland-Cliffs Inc, 2004d§).

ISG acquired the assets of Georgetown Steel Company LLC of South Carolina and planned to resume operation of the DRI facilities as ISG Georgetown. Prior to bankruptcy, Georgetown Steel imported lump ore and pellets from Canada, Brazil, and Peru. Georgetown Steel has the capacity to produce 0.5 Mt/yr of DRI, a scrap substitute. This purchase of Georgetown Steel follows the acquisition by ISG of Weirton Steel in May 2004 (International Steel Group Inc., 2004; TEX Report, 2004b).

Cliffs reached 4-year labor agreements with the United Steelworkers of America at the four operations managed by Cliffs—Hibbing Taconite and United Taconite in Minnesota, and Empire and Tilden in Michigan (Cleveland-Cliffs Inc, 2004b§).

Michigan.—Michigan accounted for less than 25% of usable iron ore output in 2004. Pellets accounted for 99.8% of this production. With the first full year of consolidation, the Empire and Tilden operations have combined management functions—accounting, finance, information technology, and purchasing—within the Cliffs Michigan Mining Company (CMMC) to make more effective use of equipment, technology, and other resources at the two nearby mines. Laboratories, maintenance, mine management, operations, and other functions work out of one facility and the Lake Superior & Ishpeming Railroad has been transferred to CMMC management to combine all internal rail operations (Frantes, 2005, p. 8).

Minnesota.—Minnesota produced more than 75% of the usable iron ore in the United States in 2004. All the State's production came from open pits on the Mesabi iron range. Minnesota pellet production, grouped by operating company, is summarized as follows: (a) Hibbing Taconite Company produced 8.4 Mt of pellets; (b) Northshore Mining Company, the site of the iron nugget pilot plant, produced 5.1 Mt of standard pellets; (c) United Taconite Company, LLC, including the now-defunct EVTAC operations, produced 4.2 Mt of pellets; (d) Mittal Steel USA produced 3.0 Mt of pellets and pellet chips—98% was flux pellets, and 2%, pellet chips; and (e) U.S. Steel Corporation produced 5.4 Mt of pellets from its Keewatin Taconite operations and 15.3 Mt of pellets from its Minntac operations (Frantes, 2005; Cleveland-Cliffs Inc, 2004c§).

Cliffs planned to expand production at its United Taconite mine and pellet plant in Minnesota. The plant expansion, the first in the Mesabi iron range since the 1970s, would increase production capacity from 4.4 Mt by about 40% during the next 2 years. United Taconite is jointly owned by Cliffs (70%) and China's Laiwu Steel Group (30%) (Skillings Mining Review, 2004a).

The idle concentrating and pelletizing facilities of the former LTV Steel Mining Company at Hoyt Lakes, MN, may no longer be available to process iron ore. PolyMet Mining Corp. (PolyMet) prepared a detailed environmental assessment worksheet for the State of Minnesota in late 2004. This worksheet triggered the permitting process for the NorthMet Project near Babbitt, MN. The NorthMet Project is a copper, nickel, and precious metal development project, which would process ore at the Hoyt Lakes facilities, now owned by Cliffs, but under option to PolyMet. Production of nonferrous metals was expected to come back onstream in 2007 (Skillings Mining Review, 2004f; PolyMet Mining Corp., 2005).

Cliffs announced plans to reactivate a furnace at its Northshore concentrating and pelletizing facilities at Silver Bay, MN. The idled furnace had an annual pellet capacity of about 810,000 metric tons (t) and was scheduled to come back onstream in 2005. The reactivation of this furnace was linked to the development of the full-scale Mesabi Nugget, LLC DRI plant scheduled to start up in 2006 near Hoyt Lakes, if permitting and financing can be arranged (Skillings Mining Review, 2004e).

U.S. Steel planned to expand pellet production at its Keewatin Taconite plant at Keewatin, MN. U.S. Steel filed a permit amendment required to upgrade production to 6.1 Mt/yr from 5.6 Mt/yr. The permit would allow the company to begin mixing coal and petroleum coke with natural gas in its pelletizing kiln, as it does at its Minntac operation at Mountain Iron, MN (Skillings Mining Review, 2004c). U.S. Steel planned to spend $24 million on the taconite plant for environmental upgrades including a wet scrubber to

remove dust that was being vented at the plant. The plant was acquired by U.S. Steel in 2003 when it purchased the assets of National Steel Corporation (Mining Engineering, 2004b).

Minntac increased recovery and lowered reagent costs at their beneficiation plant by installing hydrocyclones ahead of the flotation process. This allowed the fine, already liberated, particles to bypass the flotation stage and reduced silica slimes, a major consumer of reagents, in the flotation process (Frosaker, 2004, p. 14).

The State of Minnesota planned to provide $20 million in debt financing for the Mesabi Nugget, LLC plant, to be built near Hoyt Lakes, MN, in the form of two $10 million loans approved by Minnesota's IRR agency and the Minnesota Minerals 21st Century Fund. Mesabi Nugget announced that it expects to begin construction in 2005 and production by 2006 from the plant (Mining Engineering, 2004c).

Other States.—El Capitan Precious Metals, Inc. continued negotiating the sale of iron ore to a subsidiary of Baosteel Group of Shanghai, China. El Capitan is a development company with a 40% interest in the El Capitan Mine located near Capitan, NM (Business Wire, 2004§).

Consumption

U.S. iron ore consumption rose by almost 5% to 64.5 Mt from a revised 2003 figure of 61.6 Mt. Pig iron production at 42.3 Mt was 9% below the 10-year average of 46 Mt/yr for 1994-2003, but 4% above that of 2003. Raw steel production using BOF technology rose to 48 Mt. Although 4.5% above the 2002-04 average production, 2004 production is still far below the 9-year (1995-2003) average of 52 Mt.

Consumption of iron ore, including agglomerates, reported to the AISI by integrated producers of iron and steel totaled 63.5 Mt, including 55 Mt of pellets; 8 Mt of sinter, briquettes, and other products; and 0.5 Mt of natural coarse ore. Of the ore consumed, 82% was domestic; 9% from Canada; 8% from Brazil; and 1% from other countries. Other iron-bearing materials charged to blast furnaces included mill scale, slag scrap, and steel furnace slag.

The three consumption numbers used in this annual review are reported in tables 1, 6, and 7. The first consumption number (64.5 Mt in 2004), in table 1, is the sum of the ore consumed by ore type reported by the AISI, the ore consumed in DRI production, and the ore consumed in nonsteel uses, as reported to the USGS (American Iron and Steel Institute, 2005, p. 84). The second consumption number (63.5 Mt in 2004), in table 6, is the ore consumed in U.S. iron and steel plants by type of ore reported by the AISI. The third consumption number is no longer being reported, but previous years are listed in table 7. This consumption figure was the ore consumed in U.S. iron and steel plants by ore type, as reported by the AISI, plus the ore consumed in DRI production (0.27 Mt in 2004) and nonsteel uses (0.79 Mt in 2004). Additional data on iron ore consumption in nonsteel end uses were compiled from USGS surveys.

Price

Metals analysts were predicting iron ore price increases of greater than 20% when annual contract negotiations were concluded on April 1, 2005. Exchange rate fluctuations and strong iron ore demand worldwide were expected to strengthen the position of the iron ore producers during the upcoming annual price negotiations (Clarke, 2004a; Mining Journal, 2004i).

Early indications were that world prices for iron ore would increase significantly in the coming fiscal year. In January, Arcelor Group and Companhia Vale do Rio Doce (CVRD) agreed to the largest increase in price for fines since the early 1980s with an 18.6% increase in free-on-board (f.o.b.) prices. Prices for coking coal, another of the key inputs for steelmaking, from Australia to some of the major Asian steel producers rose by 125% in late December (Metal Bulletin, 2005).

The average f.o.b. mine value of domestic ore shipped in 2004 was $37.92 per ton, 17% higher than the revised estimate for 2003. This value approximates commercial selling price less cost of mine-to-market transport. Iron ore prices rose worldwide in 2004. The price for Rio Tinto plc's Hamersley and BHP Billiton Limited's Mount Newman fine ores for fiscal year 2004 (April 2004 to March 2005) on the Japanese market was 35.99 cents per 1% iron per long ton unit, up by 17% compared with that of 2003 (United Nations Conference on Trade and Development, 2005, p. 79). The price for lump ore was settled at 45.93 cents per 1% iron per long ton unit, an increase of 17% compared with that of 2003. The lump to fine premium for these types of Australian ore sold to Japan was 9.94 cents per 1% iron per long ton unit.

The price percentage increases were of the same order for iron ore into Europe. In spite of iron ore prices having declined in real terms through 2002, the price of Carajas fines, an ore grade produced by CVRD and sold to Europe, when denominated in U.S. dollars, reached its highest price in the past 9 years at 37.90 cents per 1% iron per metric ton (United Nations Conference on Trade and Development, 2005, p. 77).

Transportation

Shipments of iron ore in U.S.-flag vessels on the Great Lakes rebounded significantly in 2004. Iron ore cargoes for the steel industry registered a 19% tonnage increase in 2004 compared with those of 2003. U.S.-flag lake vessels loaded 46.4 Mt of iron ore in 2004, an increase of 7.4 Mt compared with those of 2003. However, 2004 iron ore shipments were only 2.5% ahead of the commodity's 5-year average (Lake Carriers' Association, 2005).

The last ocean vessel of the 2004 shipping season left the Port of Duluth (MN)-Superior (WI) on December 17. Lake traffic through the locks was to shut down on January 15. According to the U.S. Army Corps of Engineers, traffic through the locks was to recommence on March 25, 2005 (Skillings Mining Review, 2005).

Foreign Trade

Net imports in 2004 were 3.4 Mt, which represented 5.2% of domestic consumption. Exports increased by 24%, while imports decreased by 7% compared with 2003 figures. More than 96% of U.S. iron ore exports, (8.1 Mt), was pellets, and 93% of exports was shipped via the Great Lakes to Canadian steel companies, while 3.5% was shipped to China. U.S. imports totaled 11.8 Mt, of which Brazil's share increased to 43%; Canada's share decreased to 50%.

World Industry Structure

Consumption.—Global iron ore consumption is not measured directly, but there are indicators that clearly show whether it rose or fell, including imports of iron ore and production of crude steel, DRI, and pig iron. DRI and pig iron production tend to be direct indicators of iron ore consumption, while crude steel is less direct because part of steel production comes from scrap-consuming minimills. Imports of iron ore are not a direct indicator of a change in iron ore consumption in any country that produces iron ore unless the country's ore production is static. World consumption of iron ore increased as the result of an almost 9% increase in pig iron production. Of the five countries that had 5% or more of world pig iron production from 1996 through 2004, only the United States had negative growth in pig iron production. All others had increases, as follows: China, 135%; Russia, 36%; Japan, 11%; and Germany, 8%. Of the four countries that had 5% or more of world pig iron production in 2004, only the United States had a decrease (-2.5%) in production. All others increased, as follows: China, 24.5%; Russia, 4.1%; and Japan, 1.1% (United Nations Conference on Trade and Development, 2005, p. 86-87).

World crude steel production surpassed 1 billion metric tons (Gt) and rose by 9% from 2003 to 2004. Four countries accounted for 5% or more of world production in 2004. Of those countries, China produced greater than 38 Mt more crude steel in 2004 than in 2003. The others (Japan, Russia, and the United States) combined produced 10 Mt more crude steel in 2004 than in 2003. These countries along with Germany and the Republic of Korea were also the ones that accounted for 5% or more of combined world crude steel production for the years 1996 through 2004. China's production rose by 169% during that period, while that of the United States rose by about 3% (United Nations Conference on Trade and Development, 2005, p. 88-90).

Demand.—Strong markets for iron ore have led to increased interest in mine development. Increased iron ore demand continued to be driven by Chinese economic growth. In spite of new capacity and collapse of internal steel demand in Commonwealth of Independent States (CIS) countries, leading to increased steel exports, supplies of iron ore are expected to remain tight through 2006. DRI production rose to 54.6 Mt, which was 10% more than that of 2003 (Midrex Technologies, Inc., 2005§).

Production.—World production of 1.34 Gt surpassed 2003 production by 13%. World production first exceeded 1 Gt in 1995 and has continued above that level. Australia's and Brazil's combined share of world production from 2000 through 2004 averaged 36%. In 2004, iron ore was produced in 46 countries, with production exceeding 1 Mt in 24 of those countries.

Trade.—World iron ore imports of 660 Mt rose by 15% compared with 2003 levels. After very large increases in imports for the past 4 years (27% in 2000, 32% in 2001, 21% in 2002, and 33% in 2003), China posted another sharp rise to 208 Mt in 2004 from 148 Mt in 2003—a gain of greater than 40%. From 1995 through 2004, four countries accounted for more than 59% of world iron ore imports. Germany's share of imports in that period fell to 6.6% from 10.1%, Japan's share fell to 20.4% from 27.4%, and the Republic of Korea's share fell to 6.7% from 8.0%. China's share rose during this 10-year period to 31.5% from 9.4%.

Australia's and Brazil's combined share of world iron ore exports rose to 65.0% in 2004 from 63.6% in 2003. In decreasing order of market share of 2004 iron ore exports, Australia held 33.3%; Brazil, 31.7%; India, 9.9%; South Africa, 3.9%; and Canada, 3.6%. These countries represent more than 80% of world iron ore exports (United Nations Conference on Trade and Development, 2005, p. 69-72).

World freight shipping prices were at record levels in 2004. Much of this relates to China's rapidly growing demand for iron ore and other mineral commodities. One estimate of shipping costs for largest sized dry cargo vessels showed an increase of more than 1,600% since September 2001 (Australian Broadcasting Corporation ABC Radio Australia, 2004§).

According to Drewry Shipping Consultants Limited, as of mid-November, seaborne shipping rates on 100,000- to 150,000-dead-weight-ton shipments of iron ore from Brazil and South Africa to Chinese ports were up by 24% and 15%, respectively, from those of the same period of 2003 (Mining Journal, 2004j). As of the end of the third quarter 2004, seaborne time charter rates on Panamax and Cape-size vessels had increased by 99% and 90%, respectively, from a year earlier. Planned deliveries of new vessels in 2005-08, increasing the existing Panamax fleet by 22%, were expected to lower freight rates (Hennessy, 2004).

World Review

Australia.—BHP Billiton announced full-year production figures for 2004. BHP Billiton's share of salable quantities of iron ore (wet) were, as follows: Area C Joint Venture (JV) (85% owned), 11.6 Mt; Goldsworthy JV (85% owned), 4.8 Mt; Jimblebar, 6.5 Mt; Mt. Newman JV (85% owned), 23.9 Mt; Samarco Mineração S.A., Brazil, (50% owned), 7.8 Mt; and Yandi JV (85% owned), 34.5 Mt. BHP Billiton's share of total mine production was 89.1 Mt, a greater than 12% increase from that of 2003 (BHP Billiton Limited, 2004§, 2005§).

Rio Tinto (Australia) announced full-year production figures for 2004. Rio Tinto's share of salable quantities of iron ore plus pellets were from the following mines: Channar (60% owned), 5.9 Mt; Corumba, Brazil, 1.3 Mt; Eastern Range, 3.0 Mt; Hamersley, 65.4 Mt; Iron Ore Company of Canada (59% owned), 6.5 Mt; and Robe River (53% owned), 25.7 Mt. Rio Tinto's share of total mine production was 107.8 Mt, a 5% increase from that of 2003 (Rio Tinto plc, 2005§).

Aztec Resources Limited (Australia) received additional drilling results from exploration efforts on the Koolan Island iron ore property off the northwest coast of Western Australia. Extensions to three of the five deposits were identified and feasibility work was expected (Mining Journal, 2004f). Preliminary estimates showed resources of 24.8 Mt of 67% iron beneath and adjacent to the former BHP plant (TEX Report, 2004c). Earlier indications were that the deposit's total resources were greater at 39.5 Mt, but at a lower grade—64.8% iron. BHP mined iron ore on the island from 1965 to 1993.

Aztec signed a memorandum of understanding (MOU) with an undisclosed Japanese company for 0.5 Mt/yr of iron ore from the Koolan Island project. The MOU covered ore supply for the lesser of 10 years or life of mine. Aztec also signed an MOU with China Metal Products Import/Export Corporation (a subsidiary of China MinMetals Corporation) for 0.33 Mt/yr of iron ore for the lesser of 15 years or life of mine (Mining Journal, 2004a). Aztec concluded an A$5 million placement to obtain funds for completion of a bankable feasibility study on the deposit (Aztec Resources Limited, 2004§).

Murchison Metals Limited (Australia) raised capital to continue work on its Jack Hills prospect. This prospect is 350 kilometers (km) northeast of Geraldton, Western Australia. Approximately 67 Mt of inferred resources at 62% iron content are associated with the project (Border Mail, The, 2004§; Murchison Metals Ltd, 2004§).

Asia Iron Holdings (Hong Kong) signed an MOU to form a 50:50 joint venture with Nanjing Iron & Steel Group, a Chinese steel producer. The joint venture planned to mine and ship 5 Mt/yr of magnetite ore from deposits at Koolanooka and Wolla Wolla in Western Australia. The joint venture was considering building four 2.5-Mt/yr pelletizing plants at Long Tan Port on the Yangtze River near Nanjing. Mount Gibson Iron Limited will manage the magnetite mines (Metal Bulletin, 2004a).

Mount Gibson Iron officially opened Western Australia's Tallering Peak iron ore mine. It was expected to export 20 Mt of hematite ore from Tallering Peak through the Port of Geraldton during the next decade (MineBox, 2004c§). The mine continued to increase production with 263,000 t mined in the second quarter of 2004. Because of problems with shipping through the Port of Geraldton, the company was only able to ship 75% of the tonnage (Clarke, 2004c; TEX Report, 2004a). By yearend, Tallering Peak exceeded the production rate goal of 1.8 Mt/yr and expected to increase to a 2.0 Mt/yr rate at the start of 2005 (Mount Gibson Iron Limited, 2005§).

Rio Tinto plc announced that it had signed contracts to supply 40 Mt/yr of iron ore to major Chinese steel mills—75% from Hamersley Iron and 25% from the Robe River Joint Venture. This was in addition to a contract for 70 Mt during 10 years to be supplied to Shanghai Baosteel Group Corp. (Skillings Mining Review, 2004g; Rio Tinto plc, 2004§).

BHP Billiton's hot-briquetted iron (HBI) plant at Port Hedland, Western Australia, was placed on care and maintenance. An explosion with one fatality and three serious injuries earlier this year caused suspension of the operation (Mining Journal, 2004b).

Fortescue Metals Group Limited announced the appointment of Worley Group Ltd. as manager for a definitive feasibility study for the Pilbara Iron Ore Project. The A$1.87 billion project refocused development on the Christmas Creek deposits in the Chichester Range of Western Australia. Preliminary exploratory drilling was expected to be completed in 2005 and iron ore deliveries anticipated by Fortescue in 2006 (MineBox, 2004b§).

Fortescue agreed to sell Hebei Wenfeng Iron & Steel Co. Ltd. (China) 2 Mt/yr of iron ore for a period of 20 years (Fortescue Metals Group Limited, 2004a§) and also signed a 20-year binding agreement with Jiangsu Fengli Group Ltd. (China) to supply the Chinese trading conglomerate 4 Mt/yr of iron ore (Clarke, 2004b). These contracts were based upon the development of the Christmas Creek deposit in Western Australia, which was assessed to contain 744 Mt of Marra Mamba-type ore with an average in situ grade of 56.4% iron.

Subsequently, Fortescue announced a 14% increase in resources for its Christmas Creek property in the Pilbara Region. Based on additional drilling results, Fortescue increased indicated and inferred resources to 850 Mt at 56.7% iron content from the earlier estimate (MineBox, 2004a§). Fortescue announced a binding agreement with China Railway Engineering Corporation to build and finance the rail component of Fortescue's Pilbara iron ore project (Fortescue Metals Group Limited, 2004c§). The major project parameters include a memorandum of intent from a Chinese mill to purchase 10 Mt/yr of iron ore and a decision to develop the near-surface Christmas Creek iron ore deposits located closer to northern port facilities than Fortescue's other properties (Kirk, 2004b).

Fortescue signed two additional binding agreements for development of its Pilbara resources. The first, with China Harbour Engineering Group, will provide financing, design, and construction for large-scale works to include dredging and train unloading, ore stacking, blending, and ship loading facilities at Anderson Point in Port Hedland, Western Australia. The second agreement was with China Metallurgical Construction (Group) Corporation for the mine and beneficiation plant at Christmas Creek. These agreements combined with a previous agreement to finance, design, and construct railway infrastructure brought commitment of Chinese financing and construction support to A$1.85 billion for Fortescue's iron ore and infrastructure projects (Fortescue Metals Group Limited, 2004b§).

Kumba Resources Ltd., owned 66.6% by Anglo American plc, lost arbitration to its joint-venture partner Hancock Prospecting Ltd. for retaining its 50% share of the Hope Downs iron ore project. Hope Downs is a $1.3 billion, 25-Mt/yr iron ore project in Western Australia's Pilbara Range planned for production in 2007. In response, Kumba Resources filed an appeal with the Supreme Court of Western Australia to overturn the arbitration hearing and regain the 50% interest from Hancock (Mining Journal, 2004e; Bromby, 2005§).

International Minerals Pty Ltd. signed an MOU with Wuhan Iron and Steel Group concerning supply of iron ore from a proposed mining operation in Western Australia's Pilbara region. The George Palmer deposit is estimated to contain more than 800 Mt of iron ore—sufficient for 30 years of production—and is in the Fortescue Range 80 km from the Pilbara Port of Dampier (Mining Journal, 2004h).

Portman Limited (Australia) expected to double production from its iron ore mine at Cockatoo Island in northwestern Western Australia. Marine environmental impact studies, which slowed the construction of a seawall, were successfully completed, and work on the seawall was almost finished (Australian Broadcasting Corporation, 2004§). Later in September, slippage of a 90-meter (m) section of seawall was reported at the Cockatoo Island joint-venture iron ore mine. The slide prevented the Cockatoo Island operation

from reaching its planned production of 1.2 Mt/yr for 2004 (Metal Bulletin, 2004h), but Portman announced that the difficulties had been resolved by November, and that full-production capacity was expected for 2005 (Portman Limited, 2005§).

Portman planned to increase output at its Koolyanobbing Mine to 8 Mt/yr in 2005 from 5 Mt/yr. The expansion, at an estimated cost of A$55 million, involved upgrading crushing and screening capacity, improving the railway to the Port of Esperance on Western Australia's south coast, and purchasing 140 new rail cars (Mining Engineering, 2004a).

BHP Billiton and Japan's JFE Steel Corp. formed a joint venture to develop the Western 4 deposit at BHPB's Yandi Mine. This 109-Mt deposit of pisolitic ore is located in Western Australia's Pilbara region. The joint venture will become effective in July 2005 with the following ownership structure: BHP Billiton (68%), JFE (20%), Itochu Minerals & Energy Australia (6.4%), and Mitsui Iron Ore Corp. (5.6%). In addition, JFE agreed to increase its receipts of iron ore to 16 Mt/yr from 12.5 Mt/yr beginning in April 2005 (Clarke and McCulloch, 2004).

Brazil.—Brazil's CVRD announced 2004 production based on consolidated Brazilian generally accepted accounting practices (BGAAP). CVRD's share of salable quantities of iron ore was as follows: Southern System, 98.8 Mt; Carajás, 69.4 Mt; Caemi, 42.3 Mt; Samarco, 6.7 Mt; and Urucum, 0.7 Mt. The consolidated BGAAP production figures include the total production of all the companies in which CVRD has more than 50% of the voting capital and effective control with production proportional to CVRD's stake in the companies in which CVRD has shared control and excludes production volumes of companies in which CVRD has minority interests. Total iron ore production increased 11.6% from 2003 to 2004.

Based on consolidated BGAAP, CVRD announced 2004 pellet production of 35.3 Mt, an increase of 13.1% above that of 2003. CVRD's share of salable quantities of iron ore pellets was, as follows: Samarco, 6.9 Mt; São Luís. 6.1 Mt; CVRD I and II, 5.6 Mt; Fabrica, 4.6 Mt; Nibrasco, 4.3 Mt; Kobrasco, 2.2 Mt; Hispanobras, 2.0 Mt; and others, 3.6 Mt (Companhia Vale do Rio Doce, 2005§).

Studies were being conducted into the three-phase development of CVRD's Serra Sul project. CVRD planned to spend $60 million to develop a mine at Serra Sul and construct a beneficiation plant and necessary road-rail infrastructure (Mining Journal, 2004d).

CVRD signed agreements worth $5 billion to supply alumina, iron ore, and steel to Chinese plants. In return, Chinese firms planned to help build an alumina refinery and a steel plant in Brazil (McCloskey's Coal News, 2004§). In 2004, CVRD was active in signing supply agreements with firms from China, Japan, the Republic of Korea, and several nations of the European Union. On November 17, Pohang Iron & Steel Co. Ltd. (Posco) of the Republic of Korea and CVRD signed a new long-term sales contract, which called for CVRD to supply 103 Mt of iron ore during a 10-year period beginning in March 2005 (Metal Bulletin, 2004g). Additional domestic consumption of Brazilian iron ore was expected as a result of an MOU between CVRD and ThyssenKrupp Stahl A.G. of Germany. The objective of the MOU was to construct a 4.4-Mt/yr integrated slab plant in Rio de Janeiro State, Brazil (Companhia Vale do Rio Doce, 2004§).

With these new long-term agreements in hand, CVRD was able to seriously pursue financing and expansion plans for its iron ore operations. CVRD and the Japan Bank for International Cooperation signed a cooperation agreement that may further assist the Brazilian firm in its development plans (Kirk, 2004a).

CVRD analyzed four potential new pellet plants. Under consideration were a new 7-Mt/yr plant at the joint-venture complex in Espirito Santo State, a 6-Mt/yr plant at 100%-owned Mineração Brasilieras Reunidas S.A. in Minas Gerais State, a new 7-Mt/yr pelletizing plant at Samarco (a 50%-owned joint venture) in Brazil's Iron Quadrangle, and an expansion to 8.5 Mt/yr at the 50%-owned pellet plant in Bahrain (Kinch, 2005).

Companhia Siderúrgica Nacional (CSN), a leading Brazilian steelmaker, expected to expand capacity of its Casa de Pedra Mine in Minas Gerais State to 40 Mt/yr from 21.5 Mt/yr by 2006 at a cost of $310 million. According to CSN, the mine produced 15.5 Mt of ore in 2004. Stripping began for the mine expansion, and equipment ordering was begun (Metal Bulletin, 2004b).

Samarco, as part of a $550 million expansion, planned to construct a third pellet plant, build an additional 396-km slurry pipeline, and improve existing mine facilities. The new 7-Mt/yr plant would raise pellet production capacity to 21 Mt/yr. The feasibility study of this project is expected to be completed before the end of 2004 for submittal for shareholder approval. If approved, the new plant could be in operation by mid-2007 (Kirk, 2004c).

Canada.—Iron Ore Company of Canada (IOC) shipped its one billionth metric ton of iron ore. Fifty years ago, IOC shipped its first metric ton of ore over its 418-km railway from the Labrador City Mine. IOC ships approximately 21 Mt/yr through its port facility at Sept-Iles, Quebec (Telegram, The, 2004§).

United Steelworkers of America called a strike at Cliffs-managed Wabush Mines on July 5 that idled mining and concentrating facilities in Newfoundland, Canada. This was followed by a strike at the Wabush pelletizing and shipping facilities at Pointe Noire, Quebec. On July 19, workers at IOC and the Quebec North Shore and Labrador Railway voted to strike (Skillings Mining Review, 2004h). IOC is owned by Rio Tinto, 59%; Mitsubishi Corp., 26%; and Labrador Iron Ore Royalty Income Fund, 15%. By the end of July, only 1 to 5 weeks of pellet inventory with which to fulfill contracts with European customers remained at the port (Shawcross, 2004).

These labor strikes at iron ore operations in Canada continued through the summer months and into the fall. In spite of reaching agreement with union representatives in early September, IOC did not have a ratified agreement on a 3-year contract until the end of the month, after a 10-week strike. At Wabush Mines in eastern Canada, a 5-year contract was ratified by the Steelworkers Union in mid-October (Sacco, 2004a, b).

Baffinland Iron Mines Corporation reported the results of the first drill core from its 2004 program at its Mary River iron ore deposits on Baffin Island, Nunavut Territory. Drilling in the 1960s indicated a resource of 120 Mt at 68% iron content. An additional drilling program was scheduled for 2005 to delineate further resources required to support a direct-shipping iron ore operation with 10-Mt/yr capacity (Baffinland Iron Mines Corporation, 2004§).

New Millennium Capital Corp. announced partial results of a drilling program on its 80%-owned LabMag iron ore project in Labrador, 30 km west of Schefferville, Quebec. Indications from 9 of the 72 holes drilled in 2004 suggested that high-quality

concentrate of 69% iron and less than 3% silica could be produced. The drill program was designed to define an indicated resource of 660 Mt of iron ore, sufficient to operate a 10-Mt/yr mining and concentrating complex for at least 20 years (New Millennium Capital Corp., 2005§).

China.—China Iron & Steel Association reported 2004 iron ore production of 310 Mt, an increase of 19% compared with that of 2003. Iron ore grade appears to be declining and is nearly 30% iron content. According to the United Nations Conference on Trade and Development (UNCTAD), China imported 208 Mt of iron ore in 2004, 40% greater than that of 2003 (United Nations Conference on Trade and Development, 2005, p. 28).

An electrical fire at an underground iron ore mine in China's northern Hebei Province resulted in 61 fatalities. The fire is believed to have started in electrical cabling in a complex of four interconnected mines (Mining Journal, 2004c).

Guinea.—Metal Bulletin reported that Rio Tinto will be granted the Simandou iron ore concession in Guinea. Simandou is one of the last great undeveloped iron deposits in the world with an estimated 1,000 Mt of iron ore at 65% iron content. Rio Tinto expected to complete a prefeasibility study on the project by late 2006 (Swindells, 2004b).

India.—India's Kudremukh Iron Ore Company Limited (KIOCL) posted a record net profit for the first half of the year, based on production of 2.3 Mt of iron ore concentrates and 1.9 Mt of pellets. KIOCL's exports during this period were 0.2 Mt of concentrate and 2.0 Mt of pellets (Press Information Bureau, 2004§).

Liberia.—The Governments of China and Liberia reached a $10 million agreement to ship 800,000 t of abandoned iron ore stockpiled at the Port of Buchanan, Liberia, to China. Additional quantities of ore at Nimba and Wologisi in Liberia are available for purchase [Analyst (Monrovia), The, 2004§]. The LNM Group is negotiating with Liberian authorities to reopen the Yekepa iron ore mine, which ceased operation in 1992 (Jones, 2004).

Madagascar.—Cline Mining Corp. (Canada) acquired the Bekisopa iron ore deposit in Madagascar and planned to form a wholly owned subsidiary (the Madagascar Iron Ore Company) to carry the project forward. Studies performed in the late 1970s indicated a resource of 98.6 Mt with an average grade of 45% iron (Bates, 2004).

Mauritania.—Sphere Investments Limited (Australia) completed an eight-hole drilling program at Guelb el Aouj in Mauritania. The drilling information formed the basis for a three-stage bankable feasibility study that was estimated to cost $11 million (Sphere Investments Limited, 2004). The proposed mine and concentrator complex would produce 7 Mt/yr of pellets suitable for direct reduction (Australian Journal of Mining, The, 2003§). The European Investment Bank agreed to lend Sphere $5.5 million to complete the bankable feasibility study. The $650 million project would include an 18-Mt/yr magnetite mine, a beneficiation plant, and a pellet plant. Estimates showed the project area had sufficient reserves for a mine life of 30 years with production to begin in 2010 (Metal Bulletin, 2004c).

Russia.—According to Rudprom, an association of Russian iron ore producers, Russia produced 92 Mt of concentrates, 34.5 Mt of pellets, and 5.8 Mt of sinter in 2004 (Zemek, 2005). According to UNCTAD, iron ore exports increased by 7.6% compared with those of 2003.

Senegal.—Kumba Resources Limited (South Africa) signed an agreement with Miferso, a Senegalese Government project development company, in early July. Through the agreement, Kumba obtained the rights to develop a prefeasibility study for the Faleme iron ore project in Senegal. The agreement also gave Kumba an option to acquire an 80% interest in the project, which was expected to include a 12-Mt/yr mine, a 741-km railway, and a new deepwater port. The Faleme project had a preliminary capital cost estimate of $950 million (Metal Bulletin, 2004e; Mining Journal, 2004g).

South Africa.—Kumba Resources offered to invest in upgrading the railway between its Sishen Mine in Northern Cape Province and Saldanha Bay Port in Western Cape Province. The upgrade would expand rail haulage capacity to 41 Mt/yr from 29 Mt/yr. Although government officials ruled out privatization of the railway, they suggested they might be amenable to a public-private partnership, if funding is available (Business Day, 2004§).

Kumba expected to receive board approval to expand capacity at its Sishen Mine to 38 Mt/yr from its current 28 Mt/yr. The planned $350 million expansion included processing equipment, using new jigging technology, for production of two new export grades—a lump ore with 64% iron content and ore fines containing 63.5% iron. The ongoing expansion of the port was expected to be completed in July 2005 (Swindells, 2004a).

Sweden.—Luossavaara-Kiirunavaara Aktiebolag (LKAB) planned to add a new pelletizing plant, which should be operational in 2006. LKAB will spend $378 million on the new plant at its Malmberget Mine in Sweden. In its first phase, the new plant will increase LKAB's pellet capacity by 2 Mt/yr, thus maintaining the company's market share in an expanding iron ore market (Metal Bulletin, 2004f). LKAB produced 14.5 Mt of iron ore at its Kiruna operations and 7.8 Mt at Malmberget in 2004, almost 4% more than in 2003. In 2004, LKAB produced 15.9 Mt in pellet form (Luossavaara-Kiirunavaara Aktiebolag, 2005, p. 24).

Trinidad and Tobago.— Cliffs completed the sale of its partially owned HBI facility in Trinidad and Tobago to ISG. The facility has a capacity of 500,000 t/yr, but never shipped more than 130,000 t/yr of HBI when in operation (Cleveland-Cliffs Inc, 2004e§).

Ukraine.—Zaporizhstal Integrated Iron & Steel Works JSC, one of the leading industrial enterprises in Ukraine, was forced to shut down two of its blast furnaces in December owing to a dispute with Inguletsky GOK, Ukraine's leading producer of iron ore concentrates. Zaporishstal refused to pay a 30% price increase and had to reduce production while it negotiated with alternative suppliers. Similar price disputes took place between other Ukrainian steelmakers and their domestic suppliers of iron ore (Metal Bulletin, 2004d).

Venezuela.—Orinoco River channel levels roseby 0.9 m (3 feet) in November to once again allow ship-loading operations at Palua and Puerto Ordaz. Although topping off operations were still necessary for most cargoes, the backlog of shipments was expected to be caught up by yearend (Metal Bulletin, 2004i).

Vietnam.—Kunming Steel Corporation (China), Lao Cai Mineral Company (Vietnam), and Viet Nam Steel Corporation planned to jointly exploit the Quy Xa Mine in Vietnam's northern Lao Cai Province. Quy Xa holds an estimated reserve of 120 Mt of iron ore.

Feasibility studies for a 1.5- to 3.0-Mt/yr mine and associated metallurgical complex were expected to be completed in the second quarter of 2005 (China Daily, 2004§; Vietnam News Agency, 2004§).

Current Research and Technology

Excelsior Energy Inc. planned to build, own, and operate an integrated gasification combined cycle (IGCC) powerplant in northeastern Minnesota. The company was awarded a $36 million grant from the Department of Energy to plan the development of a 531-net megawatt coal-fueled clean powerplant planned to be in service in 2010. The IGCC plant would have important implications for development of the taconite and steel industries of Minnesota's Iron Range (Micheletti, 2004, p. 5; U.S. Department of Energy, 2005).

The Mesabi Nugget demonstration plant, using new technology developed by Kobe Steel Ltd.'s subsidiary Midrex Technologies, Inc. successfully completed the demonstration plant phase in July. Four test campaigns produced 10,000 t of quality pig iron nuggets (Klawonn and Hoffman, 2005§). A full-scale plant is scheduled to start up in 2006.

Rio Tinto began construction in Australia on its joint venture 0.8-Mt/yr HIsmelt® plant at Kwinana, Western Australia, in 2003 and commenced commissioning of the 6-m plant in the second half of 2004. Production of hot metal from the HIsmelt Kwinana plant was expected to commence in the second quarter of 2005 [HIsmelt (Operations) Pty. Ltd., 2005§].

Outlook

Industry experts estimated that U.S. production in 2005 would exceed that of 2004 by approximately 4% (KARE-11, 2004§).

Most U.S. iron ore production is sold directly to the domestic steel industry, although some domestic ore is shipped to Canada, and some other ore is traded for Canadian ore subsequently shipped to China. This domestic dependence is not expected to change in the near future. Information about steel industry trends is provided in the "Outlook" section in volume I, Metals and Minerals, the "Iron and Steel" chapter of the 2004 USGS Minerals Yearbook. Any growth of the U.S. iron ore industry within the next few years will be tied to the growth of the integrated steelworks along the Great Lakes, although some deposits are being considered as a source of export concentrate.

If a direct-reduction process proves economic for Great Lakes steel producers, then a significant expansion in the domestic iron ore industry could be possible. The development of DRI would allow the iron ore industry to supply the expanding minimill sector of the U.S. steel industry. Because steel alloy purities can not be readily achieved with scrap, imported DRI already plays an important role for coastal U.S. steel producers. Domestically produced DRI could become competitive further inland where cheaper power is available. Globally, even with strong DRI growth during the next decade, DRI will replace only a fraction of the world's blast furnace production. The blast furnace will remain the mainstay of the iron and steel industry during the midterm.

Key indicators of iron ore consumption—international imports of iron ore and production of iron ore and pig iron—clearly indicate that the international iron ore industry will continue to depend on the growth of iron ore consumption in China. Increased Chinese activity in overseas joint ventures, escalating imports of iron ore, and high-domestic production of low-grade ores indicate that iron ore consumption will continue to grow, although a larger portion of the consumption may be satisfied by iron ore coming from China's equity portion of joint ventures.

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TABLE 1
SALIENT IRON ORE STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

	2000	2001	2002	2003	2004
United States, iron ore, usable, less than 5% manganese:[2]					
Production	63,100	46,200	51,600	48,600 r	54,700
Shipments:					
Quantity	61,000	50,600	51,500	46,100 r	54,900
Value	1,560,000	1,210,000	1,340,000	1,490,000 r	2,080,000
Average value at mines dollars per metric ton	25.57	23.87	26.04	32.30 r	37.92
Exports:					
Quantity	6,150	5,610	6,750	6,770	8,400
Value	246,000	229,000	249,000	248,000	334,000
Imports for consumption:					
Quantity	15,700	10,700	12,500	12,600	11,800
Value	420,000	293,000	313,000	328,000	371,000
Consumption, iron ore and agglomerates	76,500	67,300	59,700 r	61,600 r	64,500
Stocks, December 31:					
At mines, plants and loading docks[3]	9,150	3,800	4,090	4,910	3,930
At receiving docks[4]	2,860	1,960	1,820	1,630	(5)
At consuming plants	16,800	12,300	12,400	10,900	(5)
Total[6]	28,800	18,000	18,300	17,500	(5)
World, production[7]	1,080,000	1,040,000 r	1,090,000 r	1,190,000 r	1,340,000 e

eEstimated. rRevised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Direct-shipping ore, concentrates, agglomerates, and byproduct ore.

[3]Excludes byproduct ore.

[4]Transfer and/or receiving docks of lower Great Lake ports.

[5]American Iron and Steel Institute no longer collects this data as of 2004.

[6]Sum of stocks at mines, consuming plants, and U.S. docks.

[7]Gross weight.

TABLE 2

EMPLOYMENT AT IRON ORE MINES AND BENEFICIATING PLANTS, QUANTITY AND TENOR OF ORE PRODUCED, AND AVERAGE OUTPUT PER WORKER HOUR IN THE UNITED STATES IN 2004, BY DISTRICT AND STATE[1]

District and State	Average number of employees	Worker hours (thousands)	Production				Average quantity per worker hour (metric tons)		
			Crude ore (thousand metric tons)	Usable ore (thousand metric tons)	Iron contained (in usable ore) (thousand metric tons)	Iron content natural (percent)	Crude ore	Usable ore	Iron contained
Lake Superior:									
Michigan[2]	1,260	2,650	38,800	13,500	8,180	60.8	14.64	5.07	3.08
Minnesota	3,130	6,480	138,000	41,300	26,300	63.8	21.34	6.37	4.06
Total or average	4,390	9,140	177,000	54,700	34,500	63.1	19.39	5.99	3.78
Other States[3]	14	29	2	1	1	54.0	0.07	0.05	0.03
Grand total or average	4,410	9,160	177,000	54,700	34,500	63.1	19.33	5.97	3.77

-- Zero.

[1]Data are rounded to no more than three significant digits, except "Average per worker hour, crude ore" and "Average per worker hour, usable ore;" may not add to totals shown.

[2]Does not include professional or clerical workers at mines, pelletizing plants, maintenance shops, or research lab workers.

[3]Includes California and South Dakota.

TABLE 3

CRUDE IRON ORE MINED IN THE UNITED STATES IN 2004, BY DISCTRICT, STATE, AND MINING METHOD[1, 2]

District and State	Number of mines	Open pit (thousand metric tons)	Underground (thousand metric tons)	Total (thousand metric tons)
Lake Superior:				
Michigan	2	38,800	--	38,800
Minnesota	6	138,000	--	138,000
Total	8	177,000	--	177,000
Other States	2	2	--	2
Grand total	10	177,000	--	177,000

-- Zero.

[1]Excludes byproduct ore and ore containing 5% or more manganese.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 4

USABLE IRON ORE PRODUCED IN THE UNITED STATES IN 2004, BY DISTRICT, STATE, AND TYPE OF PRODUCT[1, 2]

(Thousand metric tons)

District and State	Direct shipping ore	Concentrates	Agglomerates[3]	Total
Lake Superior:				
Michigan	29	--	13,400	13,500
Minnesota	--	72	41,200	41,300
Total	29	72	54,600	54,700
Other States[4]	--	1	--	1
Grand total	29	73	54,600	54,700

-- Zero.

[1]Excludes ore containing 5% or more manganese.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Data may include pellet chips and screenings.

[4]Includes California and South Dakota.

TABLE 5

SHIPMENTS OF USABLE IRON ORE FROM MINES IN THE UNITED STATES IN 2004[1, 2]

District and State	Gross weight of ore shipped (thousand metric tons)				Average iron content, natural (percent)	Value (thousands)
	Direct shipping ore	Concentrates	Agglomerates	Total		
Lake Superior:						
Michigan	32	--	13,500	13,500	60.8	W
Minnesota	--	65	41,300	41,400	63.7	W
Total reportable or average	32	65	54,800	54,900	63.0	$2,080,000
Other States[3]	--	1	--	1	54.0	W
Grand total or average	32	66	54,800	54,900	63.0	2,080,000

W Withheld to avoid disclosing company proprietary data. -- Zero.

[1]Includes byproduct ore. Excludes ore containing 5% or more manganese.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Includes California and South Dakota.

TABLE 6
CONSUMPTION OF IRON ORE AT U.S. IRON AND STEEL PLANTS, BY TYPE OF PRODUCT[1]

(Thousand metric tons)

Type of product	2003	2004
Blast furnaces:		
Direct-shipping ore	193	26
Pellets	50,400	55,000
Sinter[2]	8,850	7,900
Total	59,500	62,900
Steelmaking furnaces:		
Direct-shipping ore	492	450
Pellets	345	--
Sinter[2]	134	147
Total	971	597
Grand total	60,400	63,500

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes briquettes, nodules, and other.

Source: American Iron and Steel Institute.

TABLE 7

U.S. CONSUMPTION OF IRON ORE, BY END USE[1, 2, 3]

(Thousand metric tons)

Year	Blast furnaces[4]	Steel furnaces[4]	Sintering plants[4, 5]	Miscellaneous[4, 6]	Subtotal integrated iron and steel plants[7]	Direct-reduced iron for steelmaking[8]	Nonsteel end uses[9]	Total
2000	64,400	49	6,190	--	70,700	2,340	1,150	74,100
2001	57,300	35	4,560	--	61,900	1,800	756	64,400
2002	52,900	301	5,620	1	58,800	705	828 [e]	60,300
2003	53,800	133	5,650	--	59,500	315	791	60,600
2004	NA	NA	NA	NA	NA	270	794	NA

[e]Estimated. NA Not available. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes agglomerates. Excludes ore containing 5% or more manganese.

[3]This table will not be produced in the 2005 Minerals Yearbook unless necessary information becomes available.

[4]Data provided by American Iron and Steel Institute.

[5]Excludes dust, mill scale, and other revert iron-bearing materials.

[6]Sold to nonreporting companies or used for purposes not listed.

[7]Data provided by American Iron Ore Association.

[8]U.S. Geological Survey estimates based on production reports compiled by Midrex Corp.

[9]An estimate, which includes iron ore consumed in production of cement and iron ore shipped for use in manufacturing paint, ferrites, heavy media, cattle feed, refractory and weighing materials, and for use in lead smelting.

TABLE 8

U.S. EXPORTS OF IRON ORE, BY COUNTRY OF DESTINATION[1, 2]

(Thousand metric tons and thousand dollars)

	2003		2004	
Country	Quantity	Value	Quantity	Value
Canada	6,650	240,000	7,820	311,000
China	74	5,800	297	13,600
Other	47	1,940	276	9,780
Total	6,770	248,000	8,400	334,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes agglomerates.

Source: U.S. Census Bureau.

TABLE 9

U.S. EXPORTS OF IRON ORE, BY TYPE OF PRODUCT[1, 2]

	2003			2004		
Type of product	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)
Concentrates	6	$135	22.25	24	$695	29.36
Coarse ores	3	168	60.29	8	186	23.89
Fine ores	40	936	23.50	255	8,520	33.36
Pellets	6,700	246,000	36.72	8,100	325,000	40.06
Briquettes	(5)	4	78.72	3	114	41.63
Other agglomerates	18	761	41.47	2	172	75.97
Roasted pyrites	2	109	53.44	1	100	71.55
Total	6,770	248,000	36.65	8,400	334,000	39.82

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Includes agglomerates.

[3]Unit values shown are calculated from unrounded data.

[4]Weighted average calculated from unrounded data by dividing total value by total tonnage.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 10

U.S. IMPORTS OF IRON ORE, BY COUNTRY AND TYPE OF PRODUCT[1, 2]

Country and type of product	2003			2004		
	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)
Country:						
Australia	128	$1,110	8.63	(5)	$24	54.15
Brazil	4,980	118,000	23.71	5,020	140,000	27.97
Canada	6,970	196,000	28.07	5,830	190,000	32.53
Chile	296	6,510	22.01	244	6,380	26.15
Finland	9	452	47.98	76	6,190	81.18
Mexico	24	504	20.93	49	1,220	24.81
Peru	77	1,280	16.52	56	1,020	18.34
South Africa	--	--	--	104	4,100	39.29
Sweden	88	4,270	48.73	111	4,520	40.87
Venezuela	21	480	22.54	262	17,000	64.72
Other	4 r	107 r	26.65 r	5	205	45.19
Total	12,600	328,000	26.07	11,800	371,000	31.53
Type of product:						
Concentrates	985	20,800	21.12	1,060	24,700	23.38
Coarse ores	24	627	25.86	68	2,600	38.10
Fine ores	2,320	39,000	16.86	3,230	74,700	23.14
Pellets	8,790	258,000	29.36	7,270	256,000	35.20
Briquettes	--	--	--	56	10,500	188.39
Other agglomerates	477	9,570	20.05	75	2,070	27.48
Roasted pyrites	7	344	48.47	9	373	43.84
Total	12,600	328,000	26.07	11,800	371,000	31.53

rRevised. -- Zero.

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Includes agglomerates.

[3]Unit values shown are calculated from unrounded data.

[4]Weighted average calculated from unrounded data by dividing total value by total tonnage.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 11

U.S. IMPORTS OF IRON ORE IN 2004, BY COUNTRY AND TYPE OF PRODUCT[1, 2]

(Thousand metric tons)

Country of origin	Concentrates	Coarse ores	Fine ores	Pellets	Briquettes and other agglomerates	Roasted pyrites	Total
Australia	(3)	--	--	--	--	--	(3)
Brazil	184	--	2,120	2,720	--	--	5,020
Canada	546	--	729	4,480	75	--	5,830
Chile	239	--	5	--	--	--	244
Finland	--	4	--	65	--	7	76
Mexico	--	--	49	--	(3)	--	49
Peru	(3)	--	55	--	--	1	56
South Africa	--	(3)	104	--	--	--	104
Sweden	87	--	23	--	--	--	111
Venezuela	--	64	143	--	56	--	262
Other	--	1	4	--	(3)	(3)	5
Total	1,060	68	3,230	7,270	131	9	11,800

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes agglomerates.

[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12

AVERAGE UNIT VALUE FOR SELECTED IMPORTS OF IRON ORE IN 2004[1]

Type of product	Country of origin	Average unit value[2] (dollars per metric ton, gross weight)
Concentrates	Brazil	23.62
Do.	Canada	18.50
Do.	Chile	26.31
Fine ores	Australia	-- [3]
Do.	Brazil	20.31
Do.	Canada	28.20
Pellets	Brazil	34.23
Do.	Canada	35.02

-- Zero.

[1]Includes agglomerates.

[2]Weighted averages of individual customs values.

[3]No imports of Australian fines in 2004.

Source: U.S. Census Bureau.

TABLE 13

U.S. IMPORTS OF IRON ORE, BY CUSTOMS DISTRICT[1, 2]

(Thousand metric tons and thousand dollars)

	2003		2004	
Customs district	Quantity	Value	Quantity	Value
Baltimore, MD	3,330	73,300	3,580	115,000
Charleston, SC	106	3,490	1	55
Chicago, IL	1,220	21,000	1,450	31,300
Cleveland, OH	3,270	93,000	2,440	78,000
Detroit, MI	247	8,920	174	6,570
Houston, TX	72	2,350	57	1,590
Mobile, AL	75	2,090	84	2,900
New Orleans, LA	4,150	119,000	3,900	132,000
Philadelphia, PA	82	3,140	58	2,900
Tampa, FL	16	941	--	--
Other	28 [r]	672 [r]	19	487
Total	12,600	328,000	11,800	371,000

[r]Revised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes agglomerates.

Source: U.S. Census Bureau.

TABLE 14

U.S. IMPORTS OF PELLETS, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003		2004	
Country	Quantity	Value	Quantity	Value
Brazil	2,790	80,800	2,720	93,100
Canada	5,990	177,000	4,480	157,000
Finland	--	--	65	5,740
Total	8,790	258,000	7,270	256,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 15

SELECTED PRICES FOR IRON ORE IN THE JAPANESE MARKET[1]

(Cents per dry long ton unit of iron unless otherwise specified)

Country and producer	Ore types	April 1-March 31	
		Fiscal year 2003	Fiscal year 2004
Australia:			
Hamersley Iron Proprietary Limited and Mount Newman Mining Company Proprietary Limited	Lump ore	39.35	45.93
Do.	Fines	30.83	35.99
Robe River Iron Associates	do.	24.58	28.69
BHP Billiton (Yandi)	do.	28.98	33.83
Brazil:			
Companhia Nipo-Brasileira de Pelotizacao (Nibrasco)	Pellet feed	49.66	60.02
Companhia Vale do Rio Doce (Carajas)	Fines	28.14	32.76
Companhia Vale do Rio Doce (Itabira)	do.	27.64	32.27
Mineraçoes Brasileiras Reunidas Societe Anonyme	Lump ore	29.32	34.78
Do.	Fines	28.17	33.42
Samarco Mineracâo Societe Anonyme	Pellet feed	23.91	28.36
Canada, Iron Ore Company of Canada (Carol Lake)	Concentrates	26.81	31.80
Chile:			
Minera del Pacifico Societe Anonyme (Huasco)	Pellets	46.28	59.10
Minera del Pacifico Societe Anonyme (El Romeral)	Fines	20.31	29.51
India:			
Minerals and Metals Trading Corporation (Bailadila)	Lump ore	38.15	45.25
Do.	Fines	29.59	35.10
Peru, Shougang Hierro Peru S.A.A.	Pellet feed	21.14 [r]	25.08
South Africa			
Kumba Resources Limited (Iscor) cents per dry metric ton unit	Lump ore	31.85	37.78
Do. do.	Fines	23.45	27.28

[r]Revised.

[1]Free on board shipping port basis.

Source: Trust Fund Project on Iron Ore Information, The Iron Ore Market 2004-2006.

TABLE 16
IRON ORE: WORLD PRODUCTION, BY COUNTRY[1]

(Thousand metric tons)

Country[4]	Gross weight[2]					Metal content[3]				
	2000	2001	2002	2003	2004[e]	2000	2001	2002	2003	2004[e]
Algeria	1,645	1,291	1,202	1,378	1,410	830 [e]	650	610	700	720
Australia	167,935	181,553	182,704	187,219	230,955 [5]	104,226	112,592	113,548	116,355	143,398 [5]
Austria[e]	1,800	1,800	1,900	2,119 [r, 5]	1,800	500	575	575	703 [r, 5]	575
Azerbaijan[e]	NA	NA	(6) [r]	3 [r]	4	NA	NA	(6) [r]	2 [r]	2
Bosnia and Herzegovina	363 [r]	264 [r]	212 [r]	127 [r]	130	182 [r]	132 [r]	106 [r]	63 [r]	64
Brazil	212,576	201,430 [r]	214,560 [r]	234,470 [r]	255,000 [5]	141,106	133,713 [r]	142,468 [r]	155,693 [r]	169,300 [5]
Bulgaria	559	464	373	466 [r]	500	178	148	119	127 [r]	120
Canada[7]	35,247	27,119 [r]	30,902 [r]	33,322 [r]	28,256 [5]	22,744	17,274 [r]	19,684 [r]	20,993 [r]	17,801 [5]
Chile	8,729	8,834	7,269	8,011 [r]	8,000	5,455	5,437	4,398	4,865 [r]	4,800
China[e, 8]	223,000	220,000	231,000	261,000	310,000	73,500	72,600	76,200	86,000 [r]	102,000
Colombia	660	637	688	625	670	363	350	378	344 [e]	369
Egypt	1,900	2,600	2,300	2,900	2,900	950	1,300	1,150 [e]	1,450	1,450
Germany	462 [r]	407 [r]	419 [r]	429 [r]	412	298 [r]	232 [r]	246 [r]	258 [r]	238
Greece[e, 9]	1,500	1,500	1,500	1,500	1,500	575	575	575	575	575
Guatemala	16	15	35 [r]	23 [r]	23	11	10	23 [r]	15 [r]	15
India	75,950	79,200	86,400 [r]	99,100 [r]	120,600 [5]	48,600	50,700	55,300 [r]	63,400 [r]	77,200
Indonesia	489	469	379	245	90 [5]	269 [e]	258 [e]	216 [r, e]	140 [e]	51
Iran[10]	12,370	10,300	11,300	16,000	16,500	6,100	5,100	5,600	7,800 [r]	5,100
Japan	1	1	1	1 [r]	1 [p]	1	(6)	(6)	(6) [r]	(6)
Kazakhstan	16,160	14,140	15,423	19,300 [r]	20,300 [5]	9,200 [e]	8,000	8,700	10,933 [r]	11,499 [5]
Kenya	1	1	1	1	1	(6) [e]	(6)	(6)	(6)	(6)
Korea, North[e]	3,800	4,200	4,100	4,430 [r]	4,580	1,100 [r]	1,200	1,150	1,260 [r]	1,300
Korea, Republic of	336	195	365 [r]	365 [r]	360	188	109	164 [r]	161 [r]	160
Macedonia[e]	15	15	15	15	15	9	9	9	9	9
Malaysia	259	376	404	597	600	168	241	259	382	384
Mauritania	11,345	10,302	9,553 [r]	10,100	10,600	7,500	6,700	6,200	6,500	6,890
Mexico[11]	11,325	8,783	9,900	11,200	11,500	6,795	5,270	5,965 [r]	6,759 [r]	6,890 [5]
Morocco	6	8	9	4	4	4	4	5	2 [e]	2
New Zealand[12]	2,692	1,636	1,740 [r]	1,947 [r]	2,000	808	480 [e]	520 [r, e]	580 [r, e]	600
Nigeria	25	25	25	-- [e]	--	9	9	9	-- [e]	--
Norway	543 [e]	500	515	500 [r]	600	369 [e]	340 [e]	350	340 [r]	408
Peru	4,144	4,564	4,594	5,239 [r]	6,439 [5]	2,813	3,087	3,105	3,542	4,315 [5]
Portugal[13]	15 [e]	15	15 [e]	15	12	6 [e]	5 [e]	5	5 [e]	4
Romania[e]	116	292	341	304 [r]	280	55	76	89 [5]	82 [r, 5]	74 [5]
Russia	86,630	82,500	84,236	91,760	96,980 [5]	50,000	48,000 [e]	49,000	53,000 [e]	56,200
Serbia and Montenegro[e]	50	--	--	--	--	15	--	--	--	--
Slovakia	477	435	326	325	300	167	152	114	114	112
South Africa[14]	33,707	34,757	36,484	38,086	39,333 [5]	21,570	22,240	23,350	24,000 [e]	24,800
Sweden	20,557	19,486	20,300 [e]	21,500	22,300	13,556	12,811	13,400 [r, e]	14,100 [e]	14,700
Thailand	(6)	(6)	570 [r]	10 [r]	136 [5]	(6)	(6) [r]	285 [r]	5 [r]	68
Tunisia	182	204	198	164	244 [5]	98	109 [e]	105	87	129 [5]
Turkey	4,076	3,932	3,433 [r]	3,429 [r]	3,857 [5]	2,200	2,100 [e]	1,800 [r, e]	1,800 [r, e]	2,000
Uganda:										
Limonite	2	--	--	--	--	1 [e]	--	--	--	--
Other	2	1	--	--	--	2 [e]	1	--	--	--
Ukraine	55,883	54,650	58,900	62,498	65,550 [5]	30,600 [e]	30,000 [e]	32,300	34,300 [e]	36,000
United Kingdom	1	1	1	1 [e]	1	1 [e]	1 [e]	(6)	(6) [e]	(6)
United States	63,089	46,192	51,570	48,554 [r]	54,724 [5]	39,703	29,263	32,499	30,590 [r]	34,460 [5]
Venezuela[15]	17,353	16,902	16,684	17,954	21,600	11,092	10,817	11,100	11,900 [e]	14,200
Vietnam	300	300	300	300	300	165	165	165	165	165
Zimbabwe	451	361	272	367	307 [5]	226 [e]	184 [e]	139	188	157 [5]
Total	1,078,746 [r]	1,042,657 [r]	1,093,417 [r]	1,187,901 [r]	1,341,677	604,306 [r]	583,019 [r]	611,984 [r]	660,286 [r]	739,305

See footnotes at end of table

TABLE 16—Continued
IRON ORE: WORLD PRODUCTION, BY COUNTRY[1]

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through July 16, 2005.

[2]Insofar as availability of sources permit, gross weight in this table represent the nonduplicative sum of marketable direct-shipping iron ores and iron ore concentrates; iron agglomerates produced from imported iron ores have been excluded under the assumption that the ore from which such materials are produced has been credited as marketable ore in the country where it was mined.

[3]Data represent actual reported weight of contained metal or are calculated from reported metal content. Estimated figures are based on latest available iron content reported, except for the following countries for which grades are U.S. Geological Survey estimates: Azerbaijan, Kazakhstan, North Korea, and Ukraine.

[4]In addition to the countries listed, Cuba may also produce iron ore, but definitive information on output levels, if any, is not available.

[5]Reported figure.

[6]Less than ½ unit.

[7]Series represented gross weight and metal content of usable iron ore (including byproduct ore) actually produced, natural weight.

[8]China's gross weight iron ore production figures are significantly higher than that of other countries, because China reports crude ore production only with an average iron content of 33%, whereas other countries report production of usable ore.

[9]Nickeliferous iron ore.

[10]Data are for year beginning March 21 of that stated.

[11]Gross weight calculated from reported iron content based on grade of 60% iron.

[12]Concentrates from titaniferous magnetite beach sands.

[13]Includes manganiferous iron ore.

[14]Includes magnetite ore as follows, in thousand metric tons: 2000—2,854; 2001—2,552; 2002—2,557; 2003—2,307; and 2004—2,893.

[15]Official data reported by the Ministerio de la Industria Básica y Minería (formerly Ministerio de Energía y Minas), may differ from those published by Venezuela's only producer C.V.G. Ferrominera Orinoco CA.

TABLE 17
IRON ORE: WORLD PELLETIZING CAPACITY,
BY CONTINENT AND COUNTRY IN 2004[1]

	Rated capacity, gross weight (million metric tons)
North America:	
Canada	27.5 e
Mexico	12.0 e
United States	56.2
Total[1]	95.7
South America:	
Brazil	52.0 e
Chile	4.7
Peru	3.5 e
Venezuela	10.3 e
Total[1]	70.5
Europe:	
Netherlands	4.6 e
Russia[2]	65.0 e
Slovakia	0.5 e
Sweden	16.1
Turkey	1.5 e
Total[1]	87.7
Asia:	
Bahrain	4.0
China	43.0 e
India	11.8
Iran	9.0 e
Japan	4.0 e
Total[1]	71.8
Oceania, Australia	6.0 e
Grand total[1]	331.7

eEstimated.

[1]Data may not add to totals shown because of independent rounding.

[2]Includes Kazakhstan and Ukraine.

Sources: International Iron and Steel Instuitute; United Nations Commission on Trade and Development, Trust Fund on Iron Ore Information; U.S. Geological Survey.